1406

K/DSA-863

SAFETY ASSESSMENT

LOW LEVEL RADIOACTIVE WASTE DISPOSAL

by

B. A. Presley

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Prepared by the
Engineering Division
Oak Ridge Gaseous Diffusion Plant
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION - NUCLEAR DIVISION
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ENGINEERING TRANSMITTAL

UNION CARBIDE CORPORATION
NUCLEAR DIVISION
OAK RIDGE, TENN. – PADUCAH, KY.

XMTL NO.	ISSUE DATE
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PROCUREMENT BY*	FIELD WORK BY
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	M-81899-01
BUILDING	PLANT
K-1407	ORGDP

PROJECT TITLE
Low Level Radioactive Waste Disposal

JOB TITLE
Safety Assessment

ISSUE FOR: ☐ Procurement ☐ Info/Record ☒ Comment ☐ Approval ☐ Approved ☐ CFC ☐ Design Complet

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LIST OF ATTACHMENTS & INFORMATION

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B. A. Presley

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UCN-1201 (1235 10-79)

K/DSA-863
W. O.: M-81899-01
Date: 6/24/83

SAFETY ASSESSMENT

Low Level Radioactive Waste Disposal

1.0 INTRODUCTION

The Low Level Radioactive Waste Disposal project (Figure 1) provides facilities at the Oak Ridge Gaseous Diffusion Plant to further reduce the discharge of pollutants to nearby streams and to treat for disposal various solid wastes. The project will provide (a) Concrete Fixation Facility (CFF) which consists of dredging equipment, screening equipment, a thickener, a centrifuge, cement mixers, and casting equipment to convert waste sludges into a fixed solid; (b) Contaminated Neutralization Facility (CNF) including a batch neutralization tank to process various uranium-bearing waste streams; and (c) Fluoride Scrubber Effluent Treatment Facility (FSETF) consisting of neutralization, filtration, precipitation, centrifugation, and ion exchange processes to process a fluoride scrubber waste stream. All piping and process equipment in direct contact with effluent streams will be designed to be critically safe.

2.0 SAFETY SUMMARY

Close adherence to all applicable safety standards during design, construction, and separation of the new facilities will minimize the risks normally associated with the activities involved in this project.

Safety features whose principal purpose is accident prevention, protection and/or detection will be provided at strategic locations for use throughout the facility.

As a whole, this project is expected to be controlled through the use of standard procedures governing design, procurement and construction supplemented by Quality Assurance plans resulting from Quality Assurance Assessments. No safety systems were identified. All equipment will be designed and sized to be critically safe. Further safety documentation is not required.

3.0 SITE

The three facilities will be located on a site between K-1407 and K-1420, at the edge of an existing parking area at the west end of K-1420. One two-story building will be constructed to house portions of the CFF and the FSETF. The CNF and various components of the CFF will be located outside the building, mostly at the west end. Field dredging, screening, and collection equipment will be located near the west end of K-1407-B and -C ponds for collection of sludge from these ponds as part of the CFF subproject.

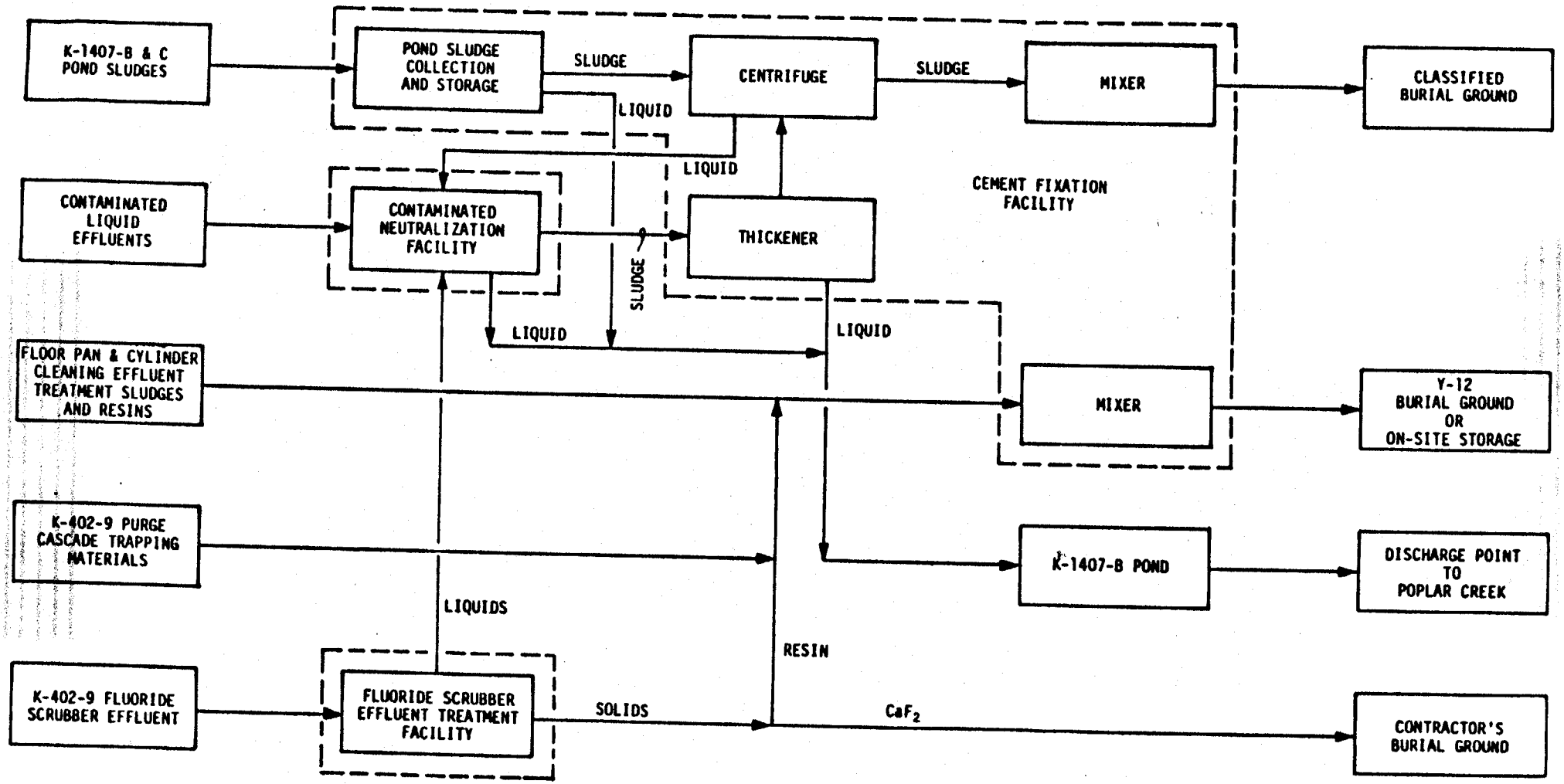

Figure 1

LOW-LEVEL RADIOACTIVE WASTE DISPOSAL OVERALL BLOCK FLOW DIAGRAM

4.0 FACILITY/PROCESS DESCRIPTION

A. CONCRETE FIXATION FACILITY (Figure 2)

Miscellaneous sludges produced throughout the plant consisting of technetium, fluorides, chlorides, potassium hydroxide, enriched uranium and tranuranics will be transferred to the Concrete Fixation Facility (CFF) for treatment and storage. This listing only includes the most hazardous materials found in the waste streams and/or sludges. Sources of the sludges will be:

1. K-1407-B & C Ponds
2. Contaminated Neutralization Facility (CNF)
3. Floor Pan & Cylinder Cleaning Effluent Treatment Facility
4. Fluoride Scrubber Effluent Treatment Facility, and
5. Purge Cascades (K-402-9)

In addition, neutralized nickel plating bath sludge may be treated on occasion. Other locally-generated sludge wastes may also be handled.

Sludges from the K-1407-B pond will be dredged by a floating dredge, pumped into a 10,000-gallon collection sump located near the pond, and then transferred to a 10,000-gallon storage tank outside the CFF, where it will be treated with polymer.

Solids-containing effluent from the CNF will be piped into a 60,000-gallon batch thickener at the CFF, where it will be concentrated to 5% solids. Decant from the thickener will be combined with decant from the storage tank and drained to K-1407-B pond.

Sludge from the storage tank and the thickener will be pumped to a centrifuge which will concentrate the sludges to about 60% solids. These sludges will be conveyed to a high-energy ribbon mixer where they, and K-1407-C pond sludge, will be mixed with cement. The mixture will be transferred into concrete mixer trucks, transported to the burial ground, and poured into underground slabs in the burial ground trenches.

Various sludges from the latter three facilities will be received in critically-safe containers. They will be transferred directly to another high-energy ribbon mixer where they will be mixed with cement and cast in critically-safe containers. These will be transported to the burial ground and buried in critically-safe geometry.

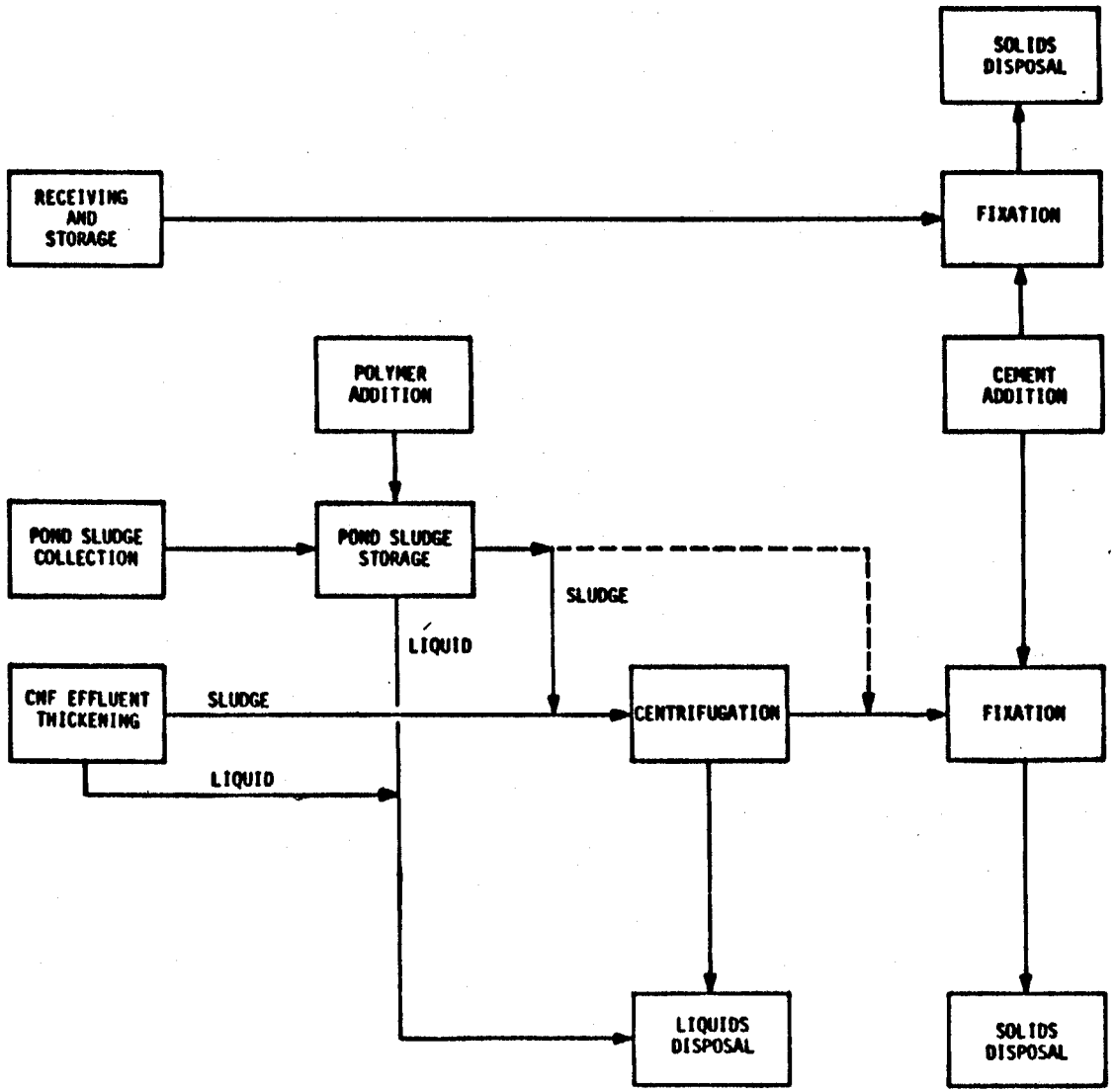

Figure 2

CONCRETE FIXATION FACILITY -- BLOCK FLOW DIAGRAM

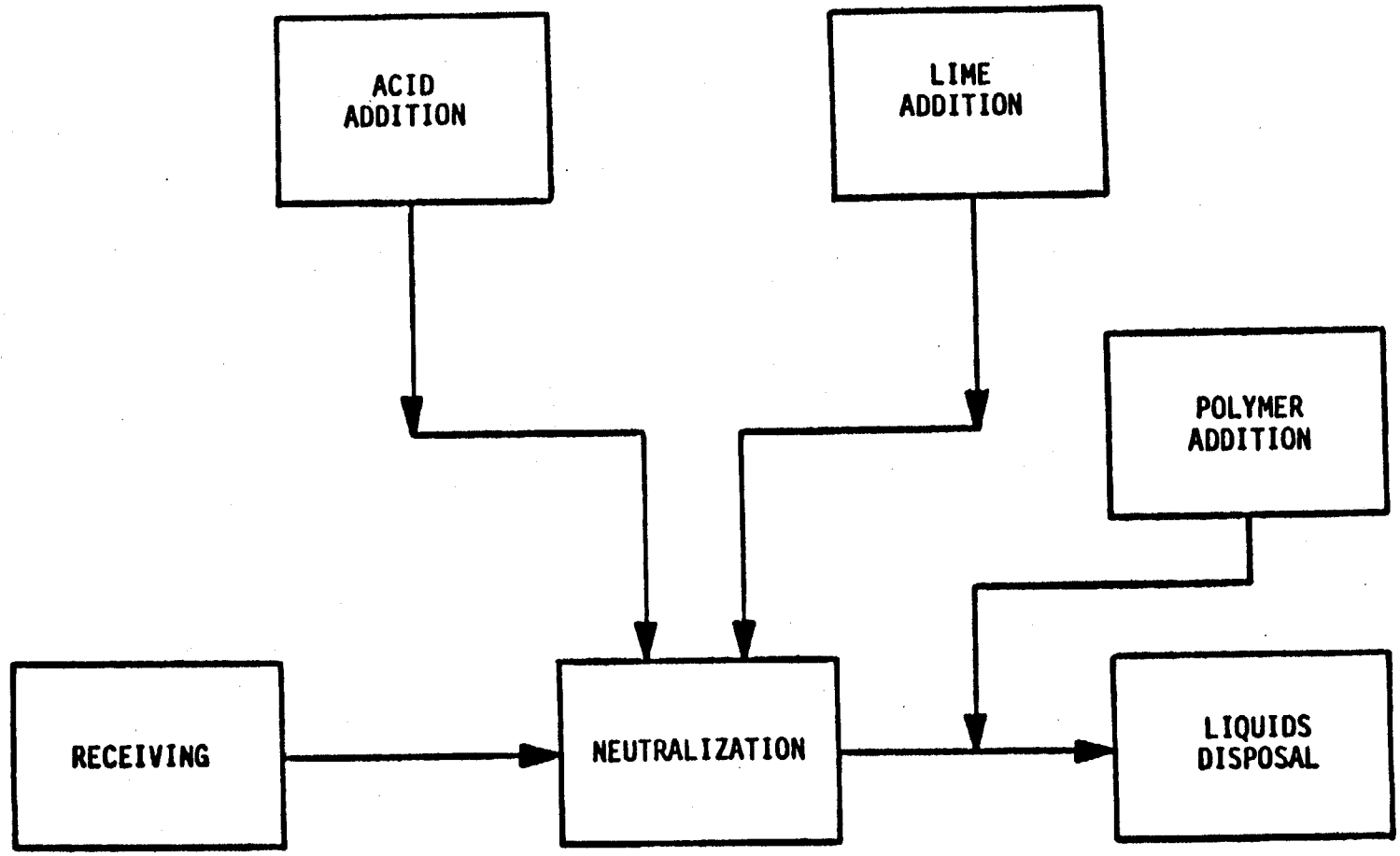

FIGURE 3

CONTAMINATED NEUTRALIZATION FACILITY - BLOCK FLOW DIAGRAM

B. CONTAMINATED NEUTRALIZATION FACILITY (Figure 3)

Various liquid wastes from different plant facilities include chromium, nitric acid, fluoride, potassium hydroxide, hydrochloric acid, enriched uranium, technetium, calcium fluoride, and will be treated at the Contaminated Neutralization Facility (CNF). The lime will be used to neutralize the streams of sludge; sulfuric acid will be available if required. This listing only includes the most hazardous materials found in the waste streams and/or sludges. These wastes include effluents from:

1. K-1401 Metal Cleaning
2. K-1420 Decontamination Spray Booth
3. TSCA Incinerator
4. Fluoride Scrubber Effluent Treatment Facility
5. Floor Pan and Cylinder Cleaning Effluent Treatment Facility, and
6. Central Sludge Fixation Facility

In addition, coal-yard runoff may be treated, also some wastes from the other plants.

The CNF will receive various contaminated effluent streams from the above facilities in a 25,000-gallon batch neutralization tank. The streams will be neutralized with lime. Sulfuric acid will be available if required. Lime and sulfuric acid storage and additional systems will be provided. Polymers will be added to the effluent stream, which will be pumped to a batch thickener, which is part of the CFF subproject. Two polymer addition systems will be included.

The CNF will be located outside the Low-Level Radioactive Waste Disposal Building at its northeast corner.

C. FLUORIDE SCRUBBER EFFLUENT TREATMENT FACILITY (Figure 4)

The Fluoride Scrubber Effluent Treatment Facility (FSETF) will be located inside the Low Level Radioactive Waste Disposal Building. Effluent from the fluoride scrubbers at K-402-9 will be treated at this facility. The facility will include (a) 1,500-gallon neutralization tank which will be used for pH adjustment; (b) a horizontal plate filter used for the removal of solids; (c) a 1,800-gallon precipitation tank used for the removal of fluorides, and (d) a centrifuge, plus an ion exchange column used for the removal of radioactive materials such as uranium and technetium from the scrubber effluent.

Filter solids will be either sent for uranium recovery or sent to the Cement Fixation Facility. Sludge from the centrifuge, which primarily consists of calcium fluoride (CaF_2) will be buried. Spent ion exchange resin will go to the Cement Fixation Facility. The liquid effluent will be pumped to the Contaminated Neutralization Facility.

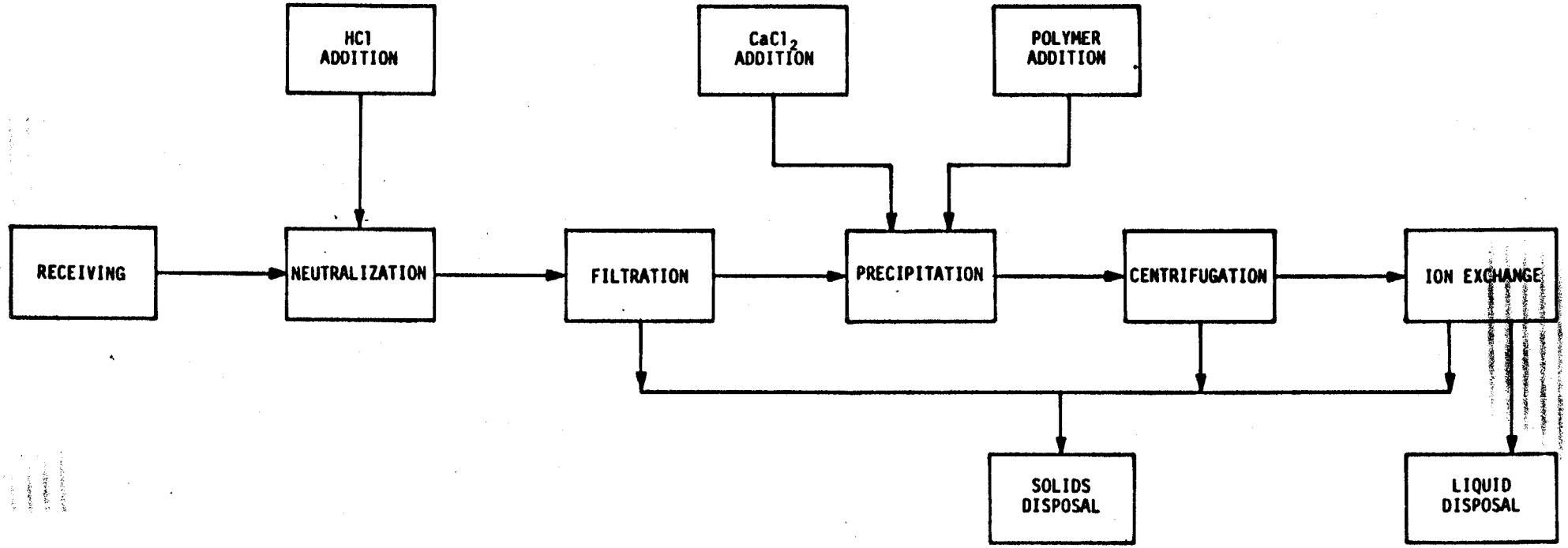

Figure 4

FLUORIDE SCRUBBER EFFLUENT TREATMENT FACILITY -- BLOCK FLOW DIAGRAM

5.0 HAZARD DEFINITION/EVALUATION

Various hazards will be addressed for each of the following subprojects:

A. Concrete Fixation Facility

Recognized hazards associated with the Concrete Fixation Facility include those associated with radioactive uranium salts and transuranics. In addition, fluorides and chemicals such as cement are potential irritants. These standard industrial materials can be handled by Standard Operating Procedures (SOP's). Personnel injury, health hazards, environmental impact and property loss arising from these materials will be minimal. Should accidents involving these materials arise, the consequences will be minimized by such actions as providing safety showers, area ventilation systems and spill control facilities in chemical handling areas, or by shutting down facilities. The facility has two equipment trains: one critically-safe train handling small amounts of materials, and another with large equipment for handling K-1407-B and C pond sludge and Contaminated Neutralization Facility sludge, which do not require criticality-safe-handling.

The sludge does contain enriched uranium particles, however, criticality accidents will be mitigated by geometrically safe design of systems that handle the sludge. Standard Practice Procedure, SPP-B-341, "Waste Disposal Management" will be adhered to because it provides details pertaining to proper disposal procedures for all waste materials, including hazardous materials. Sampling facilities will enable the operator to determine the necessary previously approved procedure to safely process the material through the remaining steps.

B. Contaminated Neutralization Facility

Recognized hazards associated with the Contaminated Neutralization Facility include chemical handling of lime and sulfuric acid which are potential irritants. These materials can also be handled by SOP's. A potential criticality problem also exists and the facility will be designed to avoid such a problem.

C. Fluoride Scrubber Effluent Treatment Facility

Recognized hazards associated with the Fluoride Scrubber Effluent Treatment Facility include the caustic and fluoride-containing nature of the influent and the chemical handling of hydrochloric acid. These can be handled by SOP's. A potential criticality problem exists, but the facility has been designed to avoid such a problem. In addition, periodic removal of spent ion-exchange resin may release dust containing technetium.

Construction safety considerations will be typical for projects of this type performed by outside construction contractors. Contract documents will include the standard provision that construction contractors comply with health, safety, and fire protection regulations and requirements.

These shall include: (1) the operational "Safety Standards" contained in DOE Manual Chapter 0550; and (2) the Safety and Health Regulations for Construction as issued by the Secretary of Labor (previously contained in 29 CFR 1518, presently contained in 29 CFR 1926).

Fire protection will be required to provide mitigation of common fire hazards involved in the operation of pollution control facilities. All fire protection will be in accordance with the National Fire Protection Association Standards. The facility will be provided with portable fire extinguishers. The design of the new building will include a fire alarm system which will be integrated into the existing plant-wide fire alarm system. The Concrete Fixation Facility will be provided with a new, automatic, wet pipe sprinkler system for additional fire protection of the facility.

Applicable standards of the Conference of Government Industrial Hygienists and the American Industrial Ventilation Manual will be followed to minimize the health hazards to personnel who will work in areas where chemical agents such as lime and acids are present. Safety showers and eye wash stations will be suitably located near the lime storage and feed system equipment. Other safety equipment cabinets and alarm systems will be installed as needed.

Construction impacts of the proposed project will be minimal. Minor surface erosion and dust problems may occur in the specific areas affected by the proposed action. Runoff from the sites during construction may contain some suspended solids. Any spoil material from excavation and project construction will be disposed of in an accepted manner. Efforts will be made to control noise, dust, and traffic during construction.